Project HC-8: Engineering properties of new storage materials

D. Dedrick
Sandia National Laboratories, Livermore, CA, USA
E-mail: dededri@sandia.gov

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Engineering material properties investigations of Ti-doped sodium alanates is underway at Sandia National Laboratories. The selection of the properties and the associated parameter space focuses on hydrogen-storage application needs. For example, the characterization of the thermal conductivity of the alanate is critical for advanced design and optimization of complex hydride-based hydrogen storage tanks. Table 1 describes the properties identified for investigation.

Table 1: List of properties

	Property	Sample Variables
1	Thermal Conductivity	Cycle, phase, gas pressure
2	Volumetric expansion pressure	Initial packing density, phase
3	DC Electrical Properties	Phase, temperature
4	AC Electrical Properties	Phase, temperature

The thermal conductivity test hardware was built and calibrated in 2003 to accomplish the above tasks. Testing on various materials provided consistent and repeatable results that fall within ranges reported in literature. Materials tested include Polytetrafluoroethylene, Polyurethane foam, and Ottawa sand. Thermal properties testing of sodium alanate with an initial packing density of 0.6 g/cc has been completed as a function of cycle, phase, gas pressure, and temperature. Other thermal properties investigations such as heat capacity and wall resistance measurements are ongoing in 2004.

In addition, a test cell has been designed and built that can measure the pressure exerted on a wall by constraining the sodium alanate. Results have been generated for initial packing densities of 0.9 g/cc. Tests will continue in 2004 at higher initial packing densities.

An electrical properties analyzing cell has been designed and built for measuring DC and AC electrical response of the alanate material. Initial tests began in 2003 and will continue in 2004. Future results will be presented as a function of phase.

All three chambers are designed to measure the properties of various complex hydrogen storage materials and will be used in the future to characterize new hydrogen storage materials or material enhancements of current materials.